(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 933 515 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
20.08.2003 Bulletin 2003/34

(21) Application number: 97944121.9

(22) Date of filing: 15.10.1997

(51) Int Cl.7: F02B 33/04, F02B 25/22, F02B 25/16, F02B 17/00, F02D 9/02, F02D 41/10

(86) International application number:
PCT/JP97/03714

(87) International publication number:
WO 98/017902 (30.04.1998 Gazette 1998/17)

(54) **STRATIFIED SCAVENGING TWO-CYCLE ENGINE**
ZWEITAKTMOTOR MIT GESCHICHTETER SPÜLUNG
MOTEUR A DEUX CYCLES, A BALAYAGE ET A CHARGES STRATIFIEES

(84) Designated Contracting States:
DE FR GB IT SE

(30) Priority: 17.10.1996 JP 27498996

(43) Date of publication of application:
04.08.1999 Bulletin 1999/31

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- PATENT ABSTRACTS OF JAPAN vol. 1995, no. 08, 29 September 1995 (1995-09-29) & JP 07 139358 A (KOMATSU ZENOAH CO), 30 May 1995 (1995-05-30)

EP 0 933 515 B1

Description

Technical Field

[0001] The present invention relates to a stratified scavenging two-cycle engine, and more particularly to a stratified scavenging two-cycle engine, in which control of an air flow rate provides favorable accelerating performance and can prevent deterioration of exhaust gas.

Background Art

[0002] As a conventional stratified scavenging two-cycle engine of this kind, a stratified scavenging two-cycle engine which includes a scavenging flow passage for connection between a cylinder chamber and a crank chamber and an air flow passage connected to the scavenging flow passage and which is structured in such a manner that pressure reduction in the crank chamber with upward movement of a piston permits mixture to be sucked into the crank chamber and permits air to be sucked into the crank chamber through the scavenging flow passage from the air flow passage is known. In the stratified scavenging two-cycle engine structured as described above, there is an advantage that combustion gas can be pushed out by air filled in the scavenging flow passage, thus greatly reducing blow-by of mixture and making exhaust gas cleaner.

[0003] In the aforesaid stratified scavenging two-cycle engine, however, there is a disadvantage that mixture is rarefied by air, whereby an air-fuel ratio (weight of air / weight of fuel) which is the substantial ratio of air to fuel becomes thinner (increases), thus deteriorating accelerating performance. As measures to improve accelerating performance, it is required that the air-fuel ratio is thickened (decreases) by increasing the supply amount of fuel also at the time of stationary engine speed in accordance with accelerating performance to suck enriched mixture into the crank chamber. In that case, however, exhaust gas at the lime of stationary engine speed other than the time of acceleration is deteriorated.

[0004] US 4 075 985 A and JP 07 139358 A disclose stratified scavenging two-cycle engines each comprising a scavenging passage leading from a crank case to a combustion chamber and an air passage connected to the scavenging passage. The amount of air delivered to the scavenging passage is controlled by an air valve operated by a rod which in turn operates a throttle valve. The air flow rate is adjusted in a fixed relationship with the throttle valve opening degree.

[0005] EP 0 413 432 A discloses a fuel-injected crankcase-scavenged two-cycle engine comprising an air intake manifold delivering air into a crank case and into a combustion chamber. The amount of air delivered through the air intake manifold is controlled in higher engine load conditions by a throttle plate actuated by an accelerator pedal and in lower engine load conditions by a bypass valve controlled by a computer. Hereby an air feed rate is reduced or kept constant during idling conditions of the engine.

Summary of the Invention

[0006] In view of the aforesaid disadvantages, an object of the present invention is to provide a stratified scavenging two-cycle engine, in which mixture and air are separately sucked in and control of a supplied flow rate of air can improve accelerating performance and can prevent deterioration of exhaust gas at the time of stationary engine speed and the time of acceleration.

[0007] The present invention includes the features as claimed in claim 1. Preferred embodiments are claimed in dependent claims.

[0008] According to the subject matter of the invention, when a piston ascends, pressure in the crank chamber lowers so that mixture flows into the crank chamber and air flows into the crank chamber through the scavenging flow passage from the air flow passage. Namely, the scavenging flow passage is filled with air, and inside the crank chamber, mixture is rarefied by air from the scavenging flow passage. Therefore, in the stratified scavenging two-cycle engine, an air-fuel ratio of mixture sucked from the mixture flow passage is set in a higher range so as to make the air-fuel ratio optimum in combustion after the mixture is rarefied by air.

[0009] Subsequently, when pressure in the cylinder chamber sharply rises by ignition of mixture in the cylinder chamber and the piston descends, pressure in the crank chamber rises. When the piston descends to a predetermined position, an exhaust port opens, for example, and combustion gas flows out of the exhaust port so that pressure in the cylinder chamber sharply drops and a scavenging port which is an end portion on the side of the cylinder chamber of the scavenging flow passage opens. Then, air in the scavenging flow passage flows into the cylinder chamber, and subsequently mixture in the crank chamber flows into the cylinder chamber through the scavenging flow passage.

[0010] Specifically, combustion gas can be pushed out of the exhaust port by only air at a point in time when scavenge starts, thus preventing deterioration of exhaust gas due to blow-by of mixture. Moreover, proper air-fuel ratio mixture can be filled in the cylinder chamber, thereby also preventing deterioration of exhaust gas. Accordingly, exhaust gas can be cleaned at the time of stationary travel.

[0011] Meanwhile, when the flow rate of mixture fed to the crank chamber is increased by the mixture flow rate control means, engine speed increases. At the time of such accelerating travel, an air flow rate is throttled by the air flow rate control means. Hence, the flow rate of air flowing into the crank chamber is relatively lower than the flow rate of mixture flowing into the same crank chamber, as compared with the time of stationary travel.

[0012] Namely, thicker air-fuel ratio mixture is filled in the cylinder chamber, thus improving accelerating performance of the engine. At this time, since the supply amount of fuel is not increased at the time of acceleration as in the prior art, the supply amount of fuel is small even at the time of acceleration, thus preventing deterioration of exhaust gas more than in the prior art. In addition, in the stratified two-cycle engine of the present invention, the supply amount of fuel is not increased at the time of acceleration, whereby deterioration of exhaust gas can be prevented more than in the prior art even at the time of stationary engine speed.

[0013] Moreover it is possible, that an air-fuel ratio becomes the same as that at stationary engine speed by eliminating delay when predetermined acceleration is obtained, whereby accelerating performance can be improved and exhaust gas after acceleration can be made cleaner than in the prior art.

Brief Description of the Drawings

[0014]

Fig. 1 is a sectional view of a stratified scavenging two-cycle engine in one embodiment according to the present invention showing a state at the time of accelerating travel;

Fig. 2 is a sectional view of the stratified scavenging two-cycle engine in the one embodiment according to the present invention showing a state at the time of stationary travel;

Fig. 3 is a schematic view of a first embodiment of an air supply delay device in the one embodiment according to the present invention;

Fig. 4 is a diagram for explaining the relationship between points in time and valve openings in the first embodiment of the air supply delay device;

Fig. 5 is a block diagram of a second embodiment of the air supply delay device in the one embodiment according to the present invention;

Fig. 6 is a flowchart of the second embodiment of the air supply delay device according to the present invention;

Fig. 7 is a diagram for explaining the relationship between points in time and valve openings in the second embodiment of the air supply delay device;

Fig. 8 is a block diagram of a third embodiment of the air supply delay device in the one embodiment according to the present invention;

Fig. 9 is a flowchart of the third embodiment of the air supply delay device according to the present invention; and

Fig. 10 is a diagram for explaining the relationship between points in time and valve openings in the third embodiment of the air supply delay device.

Best Mode for Carrying out the Invention

[0015] One embodiment of the present invention will be described below concerning the case of a crankcase lead valve-type engine with reference to Fig. 1 and Fig. 2. Incidentally, the same effect as the above can be obtained in the case of a piston valve-type engine. In a stratified scavenging two-cycle engine shown in this embodiment, as shown in Figs. 1 and 2, a mixture flow passage 10 which sucks mixture is connected to a crank chamber 1a, and an air flow passage 2 which sucks air is connected to a scavenging flow passage 3. A check valve 20 is provided at the outlet of the air flow passage 2. The check valve 20 is formed by a lead valve, allows a flow from the air flow passage 2 toward the scavenging flow passage 3, and impedes a flow from the scavenging flow passage 3 toward the air flow passage 2. A check valve 100 is provided in the mixture flow passage 10. The check valve 100 is also formed by a lead valve, allows a flow from the mixture flow passage 10 toward the crank chamber 1a, and impedes a flow from the crank chamber 1a toward the mixture flow passage 10.

[0016] Meanwhile, the scavenging flow passage 3 is provided in a crankcase 1 and a cylinder block 4 in order to lead from the crank chamber 1a into a cylinder chamber 4a. In a cylinder inner face 4b, scavenging ports 3a leading to the scavenging flow passage 3 are opened, and an exhaust port 4c for exhausting combustion gas is also opened.

[0017] A crankshaft 5 is provided in the crankcase 1, and a piston 7 is coupled to the crankshaft 5 via a connecting rod 6. The piston 7 is put into the cylinder inner face 4b and movable along the axial direction of the inner face 4b. In addition, a cylinder head 8 is provided on the cylinder block 4, and an ignition plug 9 is provided on the cylinder head 8.

[0018] A mixture flow rate control means 11 for controlling a flow rate of mixture sucked into the crank chamber 1a is provided upstream of the mixture flow passage 10. Moreover, an air flow rate control means 12 for controlling a flow rate of air sucked into the scavenging flow passage 3 from the air flow passage 2 is provided upstream of the air flow passage 2.

[0019] The mixture flow rate control means 11 controls the flow rate of mixture with a throttle valve 11a. Specifically, by opening the throttle valve 11a, the flow rate of mixture sucked into the crank chamber 1a is increased, whereby engine speed is increased. In addition, in the mixture flow rate control means 11, a carburetor 11b is integrally provided upstream of the throttle valve 11a.

[0020] The air flow rate control means 12 controls the flow rate of air with an on-off valve 12a. The on-off valve 12a throttles an opening when the flow rate of mixture fed to the crank chamber 1a is increased by the throttle valve 11a and engine speed is increased, that is, at the time of accelerating travel. Specifically, the on-off valve 12a detects that the throttle valve 11a is changing in an

opening direction and throttles an air flow rate.

[0021] In the stratified two-cycle engine structured as described above, as shown in Fig. 2, when the piston 7 ascends, pressure in the crank chamber 1a lowers so that mixture flows into the crank chamber 1a from the mixture flow passage 10 and air flows into the crank chamber 1a through the scavenging flow passage 3 from the air flow passage 2. Namely, the scavenging flow passage 3 is filled with air, and inside the crank chamber 1a, mixture is rarefied by air. Therefore, an air-fuel ratio of mixture sucked from the mixture flow passage 10 is set in a lower range so as to make the air-fuel ratio optimum in combustion after the mixture is rarefied by air.

[0022] Subsequently, when pressure in the cylinder chamber 4a sharply rises by ignition of mixture in the cylinder chamber 4a and the piston 7 descends, pressure in the crank chamber 1a rises. When the piston 7 descends to a predetermined position, the exhaust port 4c opens and combustion gas flows out of the exhaust port 4c so that pressure in the cylinder chamber 4a sharply drops and the scavenging ports 3a open. Then, air in the scavenging flow passage 3 flows into the cylinder chamber 4a, and subsequently mixture in the crank chamber 1a flows into the cylinder chamber 4a through the scavenging flow passage 3.

[0023] Specifically, combustion gas can be pushed out of the exhaust port 4c by only air at a point in time when scavenge starts, thus preventing deterioration of exhaust gas due to blow-by of mixture. Moreover, proper air-fuel ratio mixture can be filled in the cylinder chamber 4a, thereby also preventing deterioration of exhaust gas. Accordingly, exhaust gas can be cleaned at the time of stationary travel shown in Fig. 2.

[0024] Meanwhile, when the flow rate of mixture fed to the crank chamber 1a is increased by the mixture flow rate control means 11, engine speed increases. At the time of such accelerating travel, an air flow rate is throttled by the air flow rate control means 12 as shown in Fig. 1. Hence, the flow rate of air flowing into the crank chamber 1a is relatively lower than the flow rate of mixture flowing into the same crank chamber 1a, as compared with the time of stationary travel. Namely, lower air-fuel ratio mixture is filled in the cylinder chamber 4a, thus improving accelerating performance of the engine. Since the total amount of fuel fed to mixture is smaller than in the prior art with delay of an air quantity to be supplied, exhaust gas at the time of acceleration can be made cleaner than in the prior art. Moreover, since the supply amount of fuel no longer needs to be determined in view of an air-fuel ratio at the time of acceleration, the supply amount of fuel can be set in a lower range at stationary engine speed and exhaust gas can be made cleaner than in the prior art.

[0025] Next, a case will be explained where an air flow rate is throttled by the aforesaid air flow rate control means 12 and the air flow rate flows into the crank chamber 1a later than a mixture flow rate. Fig. 3 shows a schematic view of a first embodiment of an air supply delay device 20 which is controlled by a mechanism and supplies an air flow rate later. A mixture link 21 is linked to the throttle valve 11a of the mixture flow rate control means 11 via a mixture spring 22 and linked to a throttle lever 23 for accelerating or decelerating engine speed. An air first link 24 is linked to the on-off valve 12a of the air flow rate control means 12 via an air first spring 25 and linked to the throttle lever 23 for accelerating or decelerating engine speed by an air second link 26 via a shock absorber 30, together with the mixture link 21. In the shock absorber 30 in an example shown, an air second spring 27 is inserted between the air first link 24 and the air second link 26, and a spring constant Ka of the air second spring 27 is set in a lower range than a spring constant Kb of the air first spring 25. Although a spring is used for the shock absorber 30 in the aforesaid embodiment, an assistant cylinder, an accumulator, or the like can be also used.

[0026] Next, operation will be described with reference to Fig. 3 and Fig. 4. When an operator wants to accelerate the engine, the throttle lever 23 is manipulated in an accelerating direction. A movement of the throttle lever 23 in the accelerating direction is transmitted to the throttle valve 11a via the mixture link 21 and the mixture spring 22, whereby the throttle valve 11a of the mixture flow rate control means 11 is rotated to be opened further. Thus, the flow rate of mixture sucked into the crank chamber 1a is further increased and sucked in accordance with the amount of manipulation as shown in a full line Zb in Fig. 4. At the same time, the movement of the throttle lever 23 in the accelerating direction rotates the on-off valve 12a of the air flow rate control means 12 to be opened further via the air second link 26, the shock absorber 30, and the air first link 24 in sequence. At this time, in the shock absorber 30, the air second spring 27 having the lower spring constant Ka is bent responsive to a movement of the air second link 26, and the air first link 24 is moved after the air second spring 27 is bent by a predetermined amount. Accordingly, after receiving the movement of the air second link 26, the shock absorber moves the air first link 24 with delay. Thus, in the opening amount of the on-off valve 12a of the air flow rate control means 12, delay is brought about by the shock absorber 30 as shown in a dotted line Za in Fig. 4, and the on-off valve is opened to a predetermined position which is set by the throttle lever 23 later than the throttle valve 11a at all times. By delay of the air quantity to be supplied, lower air-fuel ratio mixture is filled in the cylinder chamber 4a, thus improving accelerating performance of the engine. At this time, with the delay of the air quantity to be supplied, the total amount of fuel fed to mixture is smaller than in the prior art, whereby exhaust gas at the time of acceleration can be made cleaner than in the prior art. Moreover, since the supply amount of fuel no longer needs to be determined in view of an air-fuel ratio at the time of acceleration, the supply amount of fuel can be set in

a lower range at stationary engine speed and exhaust gas can be made cleaner than in the prior art.

[0027] Fig. 5 shows a schematic diagram of a second embodiment of an air supply delay device 20A which supplies an air flow rate later. Incidentally, the second embodiment is electronically controlled, which shows an example in which the opening amount of the on-off valve 12a of the air flow rate control means 12 is throttled more than that of the throttle valve 11a of the mixture flow rate control means 11. A mixture servo-motor 31 is attached to the throttle valve 11a of the mixture flow rate control means 11, the mixture servo-motor 31 being connected to a control element 34 such as a controller via a mixture position control servo amplifier 32 and a mixture D/A converter 33 and operating in accordance with commands from the control element 34. An air servo-motor 35 is attached to the on-off valve 12a of the air flow rate control means 12, the air servo-motor 35 being connected to the control element 34 such as a controller via an air position control servo amplifier 36 and an air D/A converter 37 and operating in accordance with commands from the control element 34. Provided in the throttle lever 23 is a movement sensor 38 for detecting the amount of movement (or the amount of rotation) of the throttle lever 23. A signal from the movement sensor 38 is inputted to the control element 34 via an A/D converter 39. A CPU, a ROM, a RAM, and a timer are provided in the control element 34. Although an example in which the servo-motors are used for opening and closing the throttle valve 11a and the on-off valve 12a is shown above, an electromagnetic proportional control valve which controls a flow rate with a solenoid, a step motor, or the like may be used.

[0028] Next, operation will be described, based on a flowchart shown in Fig. 6.

[0029] At START in step 1, when the engine starts, the control element 34 executes control operations at regular intervals, for example, at 10 msec intervals by interrupt of a timer 1.

[0030] In step 2, input processing of throttle openings is executed. A voltage value according to the amount of movement from the movement sensor 38 is converted to a digital value through the A/D converter 39 to be inputted to the CPU. In the control element 34, data of an address corresponding to a throttle opening which is already stored in the RAM are moved to data stored in an address corresponding to the preceding throttle opening, and data corresponding to a throttle opening which is inputted to the CPU from the A/D converter 39 this time is stored in an address corresponding to a throttle opening which is already stored. In addition, the control element 34 converts a voltage value according to the amount of movement from the movement sensor 38 to a digital value through the AID converter 39 and receives it in the CPU, and subsequently outputs an opening command to the mixture servo-motor 31 so that the flow rate of mixture according to the amount of movement stored in the ROM flows.

[0031] In step 3, data of an address corresponding to an air flow rate map stored in the ROM are read out from the present throttle opening which is obtained in step 2.

[0032] In step 4, data of a throttle opening obtained last time and data of a throttle opening obtained this time are compared, and whether the engine is in acceleration or not is determined from whether the throttle opening obtained this time is increased more than the throttle opening obtained last time or not.

[0033] When the throttle opening obtained this time is the same as or is smaller than the throttle opening obtained last time in step 4, the procedure advances to step 5.

[0034] In step 5, when the throttle opening obtained this time is the same as the throttle opening obtained last time, the same command value as that of the throttle opening obtained last time is outputted to the on-off valve 12a of the air flow rate control means 12 as an opening command, and when the throttle opening obtained this time is smaller than the throttle opening obtained last time, a command value for letting the flow rate of air according to the amount of movement of the throttle lever 23 which is stored in the ROM flow is outputted to the on-off valve 12a of the air flow rate control means 12 as an opening command, respectively. The control element 34 outputs an opening command to the mixture servo-motor 31 so that the flow rate of mixture according to the amount of movement of the throttle lever 23 stored in the ROM flows. Further in the above, the mixture flow rate control means 11 may be a mechanical control means which uses the mixture link 21 shown in Fig. 3 without being electronically controlled.

[0035] When the throttle opening obtained this time is larger than the throttle opening obtained last time in step 4, the procedure advances to step 6 after the amount of acceleration is obtained.

[0036] In step 6, predetermined throttle amount data X according to the amount of acceleration stored in the ROM is subtracted from air quantity data D found from the air flow rate map obtained in step 3 to find throttle air flow rate data Dx.

[0037] In step 7, whether the throttle air flow rate data Dx obtained in step 6 is larger than minimum air flow rate data Do of the engine or not is determined.

[0038] When the throttle air flow rate data Dx is smaller than the minimum air flow rata data Do, the procedure advances to step 8.

[0039] In step 8, the CPU outputs the minimum air flow rate data Do to the air D/A converter 37, and the air D/A converter 37 converts it to a predetermined voltage value to be outputted to the air position control servo amplifier 36. The air position control servo amplifier 36 rotates the air servo-motor 35 to a position proportional to the voltage value. The control element 34 outputs an opening command to the mixture servo-motor 31 so that the flow rate of mixture according to the amount of movement of the throttle lever 23 stored in the ROM flows. Further in the above, the mixture flow rate control

means 11 may be a mechanical control means which uses the mixture link 21 shown in Fig. 3 without being electronically controlled.

[0040] When the throttle air flow rate data Dx is larger than the minimum air flow rate data Do in step 7, the procedure advances to step 9.

[0041] In step 9, the CPU outputs the throttle air flow rate data Dx to the air D/A converter 37, and the air D/A converter 37 converts it to a predetermined voltage value to be outputted to the air position control servo amplifier 36. The air position control servo amplifier 36 rotates the air servo-motor 35 to a position proportional to the voltage value so that the on-off valve 12a of the air flow rate control means 12 is throttled. The control element 34 outputs an opening command to the mixture servo-motor 31 so that the flow rate of mixture according to the amount of movement of the throttle lever 23 stored in the ROM flows. Further in the above, the mixture flow rate control means 11 may be a mechanical control means which uses the mixture link 21 shown in Fig. 3 without being electronically controlled. As shown with a dotted line Va in Fig. 7, the on-off valve 12a of the air flow rate control means 12 is throttled more than the throttle valve 11a of the mixture flow rate control means 11 by the throttle amount data X, and the air servo-motor 35 operates while being throttled more than the mixture servo-motor 31. Therefore, a supplied air quantity is decreased and mixture of lower air-fuel ratio is filled in the cylinder chamber 4a, thus improving accelerating performance of the engine. In Fig. 7, the horizontal axis represents time, the vertical axis represents the opening amount of a valve, the dotted line Va shows the case of the on-off valve 12a of the air flow rate control means 12, and a full line Vb shows the case of the throttle valve 11a of the mixture flow rate control means 11. When a valve opening amount Qa is changed to an accelerated valve opening amount Qb in the drawing, the opening amount of the throttle valve 11a of the mixture flow rate control means 11 increases as shown with the full line Vb, and the opening amount of the on-off valve 12a of the air flow rate control means 12 remains in a position where it is for a predetermined period of time as shown with a dotted line Va. As a result, the opening amount of the on-off valve 12a of the air flow rate control means 12 increases later than the opening amount of the throttle valve 11a of the mixture flow rate control means 11 while being throttled more than the opening amount of the throttle valve 11a of the mixture flow rate control means 11. Thus, similarly to the above, with delay in an air quantity to be supplied, the total amount of fuel fed to mixture is smaller than in the prior art, whereby exhaust gas at the time of acceleration can be made cleaner than in the prior art. Moreover, since the supply amount of fuel no longer needs to be determined in view of an air-fuel ratio at the time of acceleration, the supply amount of fuel can be set in a lower range at stationary engine speed and exhaust gas can be made cleaner than in the prior art.

[0042] Next, a third embodiment of an air supply delay device 20B will be described. The configuration of parts of the third embodiment is different from that of the second embodiment in Fig. 5 in that two timers 41 and 42 are provided in a control element 34A, the mixture D/A converter 33, the mixture position control servo amplifier 32, and the mixture servo-motor 31 are omitted, and that the throttle valve 11a in the mixture flow rate control means 11 is connected to the throttle lever 23 via the mixture link 21. A controlling method of the third embodiment is an example in which the opening of the on-off valve 12a of the air flow rate control means 12 is made later than the throttle valve 11a of the mixture flow rate control means 11. Incidentally, the same parts as those in Fig. 5 are denoted by the same numerals and symbols and the explanation thereof is omitted.

[0043] The controlling method by the control element 34A will be described, based on a flowchart shown in Fig. 9.

[0044] At START in step 21, when the engine starts, the control element 34A executes control operations at regular intervals, for example, at 10 msec intervals by interrupt of a timer 41.

[0045] In step 22, input processing of throttle openings is executed. A voltage value according to the amount of movement from the movement sensor 38 is converted to a digital value through the A/D converter 39 to be inputted to the CPU. In the control element 34A, data of an address corresponding to a throttle opening which is already stored in the RAM are moved to data stored in an address corresponding to the preceding throttle opening, and data corresponding to a throttle opening which is inputted to the CPU from the A/D converter 39 this time is stored in an address corresponding to a throttle opening which is already stored.

[0046] In step 23, data of an address corresponding to an air flow rate map stored in the ROM are read out from the present throttle opening which is obtained in step 22.

[0047] In step 24, data of an address corresponding to the air flow rate map stored in the ROM from the present throttle opening which is obtained in step 23 is outputted to the air D/A converter 37, and the air D/A converter 37 converts it to a predetermined voltage value to be outputted to the air position control servo amplifier 36. The air position control servo amplifier 36 rotates the air servo-motor 35 to a position proportional to the voltage value.

[0048] In step 25, data of the throttle opening obtained last time and data of a throttle opening obtained this time are compared, and whether the engine is in acceleration or not is determined from whether the throttle opening obtained this time is increased more than the throttle opening obtained last time or not.

[0049] When the throttle opening obtained this time is the same as or is smaller than the throttle opening obtained last time in step 25, the air servo-motor 35 is rotated to a position at which output is conducted to the

air D/A converter 37 in step 24.

[0050] When the throttle opening obtained this time is larger than the throttle opening obtained last time in step 25, the procedure advances to step 26.

[0051] In step 26, a delay time t o is counted by a timer 42, during which interrupt for executing control operations by the timer 41 is stopped. After the delay time t o is counted by the timer 42, interrupt is resumed. Thus, the air servo-motor 35 starts to operate later than the throttle valve 11a in the mixture flow rate control means 11. Consequently, as shown with a dotted line Ya in Fig. 10, the on-off valve 12a of the air flow rate control means 12 starts to operate later than the throttle valve 11a of the mixture flow rate control means 11 by the delay time t o, whereby delay in an air quantity to be supplied occurs and thicker air-fuel ratio mixture is filled in the cylinder chamber 4a, thus improving accelerating performance of the engine. In Fig. 10, the horizontal axis represents time, the vertical axis represents the opening amount of a valve, a dotted line Ya shows the case of the on-off valve 12a of the air flow rate control means 12, and a full line Yb shows the case of the throttle valve 11a of the mixture flow rate control means 11. When a valve opening amount Qa is changed to an accelerated valve opening amount Qb in the drawing, the opening amount of the throttle valve 11a of the mixture flow rate control means 11 increases as shown with the full line Yb, and the opening amount of the on-off valve 12a of the air flow rate control means 12 increases after the delay time t o as shown with the dotted line Ya and subsequently increases similarly to that of the throttle valve 11a of the mixture flow rate control means 11. As a result, the same effect that is described above can be obtained at the time of acceleration, and moreover since an air quantity increases when predetermined acceleration is obtained, the air-fuel ratio becomes the same as that at stationary engine speed, whereby accelerating performance can be improved and exhaust gas after acceleration can be made cleaner than in the prior art.

[0052] In the aforesaid embodiment, the on-off valve 12a is structured to be throttled by detecting that the throttle valve 11a is changing in an opening direction. Specifically, when the throttle valve 11a is changing in an opening direction, the engine is regarded as being at the time of accelerating travel, whereby the on-off valve 12a is throttled. However, the engine may be also regarded as being at the time of accelerating travel by an increase in engine speed and thereby the on-off valve 12a is structured to be throttled. Namely, the on-off valve 12a may be structured to throttle an opening by detecting that the rotational frequency of the crankshaft 5 is changing in an increasing direction, for example.

Industrial Availability

[0053] The present invention is useful as a stratified scavenging two-cycle engine, in which control of an air flow rate provides favorable accelerating performance and can prevent deterioration of exhaust gas.

Claims

1. A stratified scavenging two-cycle engine comprising a scavenging flow passage (3) for connection between a cylinder chamber (4a) and a crank chamber (1a), an air flow passage (2) connected to the scavenging flow passage (3), air flow rate control means (12) for controlling a flow rate of air fed to the scavenging flow passage (3) from the air flow passage (2), and mixture flow rate control means (11) for controlling a flow rate of mixture sucked into the crank chamber (1a) from a mixture flow passage (10),

   wherein at the time of an acceleration operation, said mixture flow rate control means (11) controls the flow rate of mixture sucked into the crank chamber (1a) to be increased with respect to a normal operation, and said air flow rate control means (12) controls the flow rate of air to the scavenging flow passage (3) to be throttled more than flow rate of the mixture.

2. Engine according to claim 1, wherein the quantity of air which flows into the crank chamber (1a) with said flow rate more throttled, is relatively smaller than said increased quantity of mixture, which flows into the crank chamber (1a), as compared with the time of a normal operation.

3. Engine according to claim 1 or 2, wherein said air flow rate control means (12) controls the quantity of air to the scavenging flow passage (3) to be be more throttled , by reducing the air flow rate to the scavenging flow passage (3) at the time of the acceleration operation.

4. Engine according to claim 1 or 2, wherein said air flow rate control means (12) controls the quantity of air to the scavenging flow passage (3) to be more throttled , by being opened later than said mixture flow rate control means (11) at the time of the acceleration operation.

Patentansprüche

1. Schichtspülungs-Zweitakt-Motor mit einer Spülungsstrompassage (3) zur Verbindung zwischen einer Zylinderkammer (4a) und einer Kurbelkammer (1a), einer Luftstrompassage (2), die mit der Spülungsstrompassage (3) verbunden ist, einem Luftdurchsatzsteuermittel (12) zum Steuern des Durchsatzes von Luft, die von der Luftstrompassage (2) zu der Spülungsstrompassage (3) gespeist wird, und einem Gemischdurchsatzsteuermittel

(11) zum Steuern des Durchsatzes von Gemisch, das von einer Gemischstrompassage (10) in die Kurbelkammer (1a) gesaugt wird,
wobei zu der Zeit eines Beschleunigungsbetriebs das Gemischdurchsatzsteuermittel (11) den Durchsatz von Gemischs steuert, das in die Kurbelkammer (1a) gesaugt wird, um bezogen auf einen normalen Betrieb erhöht zu sein, und das Luftdurchsatzsteuermittel (12) den Durchsatz von Luft zu der Spülungsstrompassage (3) steuert, um stärker als der Durchsatz des Gemischs gedrosselt zu sein.

2. Motor gemäß Anspruch 1, wobei die Luftmenge, die in die Kurbelkammer (1a) mit dem stärker gedrosselten Durchsatz strömt, relativ kleiner ist als die erhöhte Menge von Gemisch, die in die Kurbelkammer (1a) strömt, verglichen mit der Zeit eines normalen Betriebs.

3. Motor gemäß Anspruch 1 oder 2, wobei das Luftdurchsatzsteuermittel (12) die Menge von Luft zu der Spülungsstrompassage (3) durch Reduzieren des Luftdurchsatzes zu der Spülungsstrompassage (3) zu der Zeit des Beschleunigungsbetriebs steuert, um stärker gedrosselt zu sein.

4. Motor gemäß Anspruch 1 oder 2, wobei das Luftdurchsatzsteuermittel (12) die Menge von Luft zu der Spülungsstrompassage (3) durch später geöffnet zu werden als das Gemischdurchsatzsteuermittel (11) zu der Zeit des Beschleunigungsbetriebs steuert, um stärker gedrosselt zu sein.

Revendications

1. Moteur deux temps à balayage et charges stratifiées, comprenant un passage d'écoulement de balayage (3) de liaison entre une chambre de cylindre (4a) et une chambre de vilebrequin (1a), un passage d'écoulement d'air (2) relié au passage d'écoulement de balayage (3), un moyen de commande (12) de débit d'air pour commander un débit d'air amené au passage d'écoulement de balayage (3) à partir du passage d'écoulement d'air (2), et un moyen de commande (11) de débit de mélange pour commander un débit de mélange aspiré dans la chambre de vilebrequin (1a) à partir d'un passage d'écoulement de mélange (10),
dans lequel au moment d'une opération d'accélération, ledit moyen de commande (11) de débit de mélange commande le débit de mélange aspiré dans la chambre de vilebrequin (1a) de façon qu'il soit augmenté par rapport à un fonctionnement normal, et ledit moyen de commande (12) de débit d'air commande le débit d'air jusqu'au passage d'écoulement de balayage (3) pour qu'il soit plus étranglé que le débit du mélange.

2. Moteur selon la revendication 1, dans lequel la quantité d'air qui s'écoule dans la chambre de vilebrequin (1a), avec ledit débit plus étranglé, est relativement plus petite que ladite quantité augmentée de mélange, qui s'écoule dans la chambre de vilebrequin (1a), comparativement au moment d'un fonctionnement normal.

3. Moteur selon la revendication 1 ou 2, dans lequel ledit moyen de commande (12) de débit d'air commande la quantité d'air jusqu'au passage d'écoulement de balayage (3) pour qu'il soit plus étranglé, par réduction du débit d'air jusqu'au passage d'écoulement de balayage (3) au moment de l'opération d'accélération.

4. Moteur selon la revendication 1 ou 2, dans lequel ledit moyen de commande (12) de débit d'air commande la quantité d'air jusqu'au passage d'écoulement de balayage (3) pour qu'il soit plus étranglé, en l'ouvrant plus tardivement que ledit moyen de commande (11) de débit de mélange au moment de l'opération d'accélération.

FIG.1

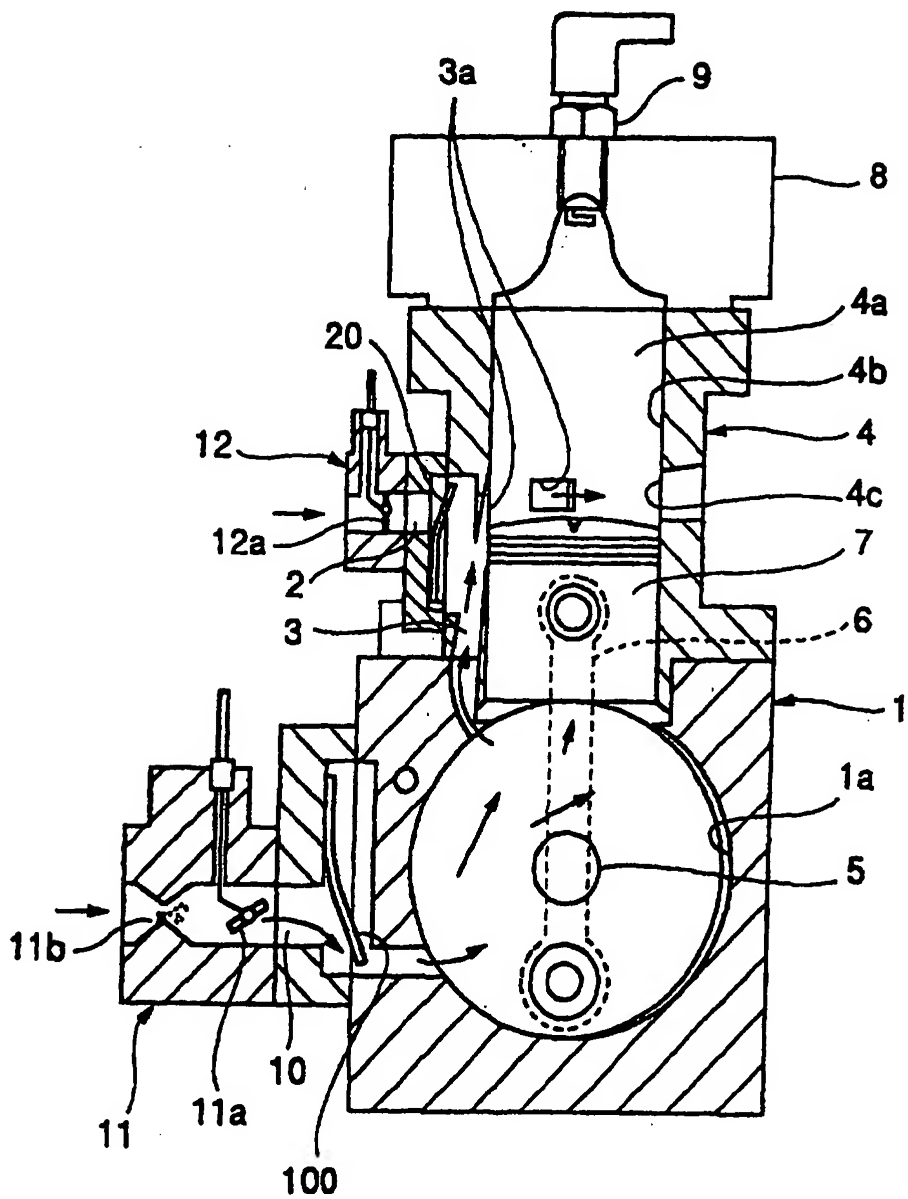


FIG.2

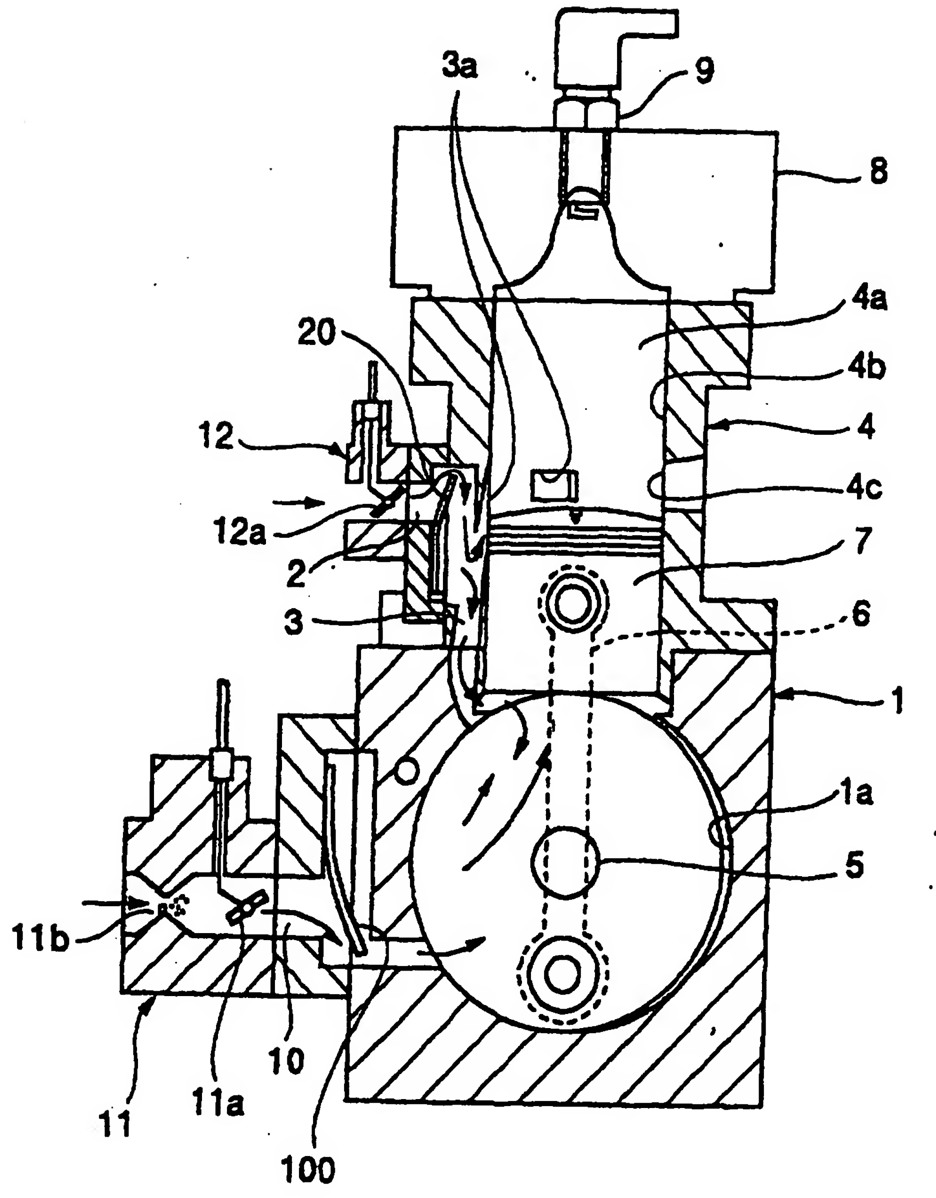


FIG.3

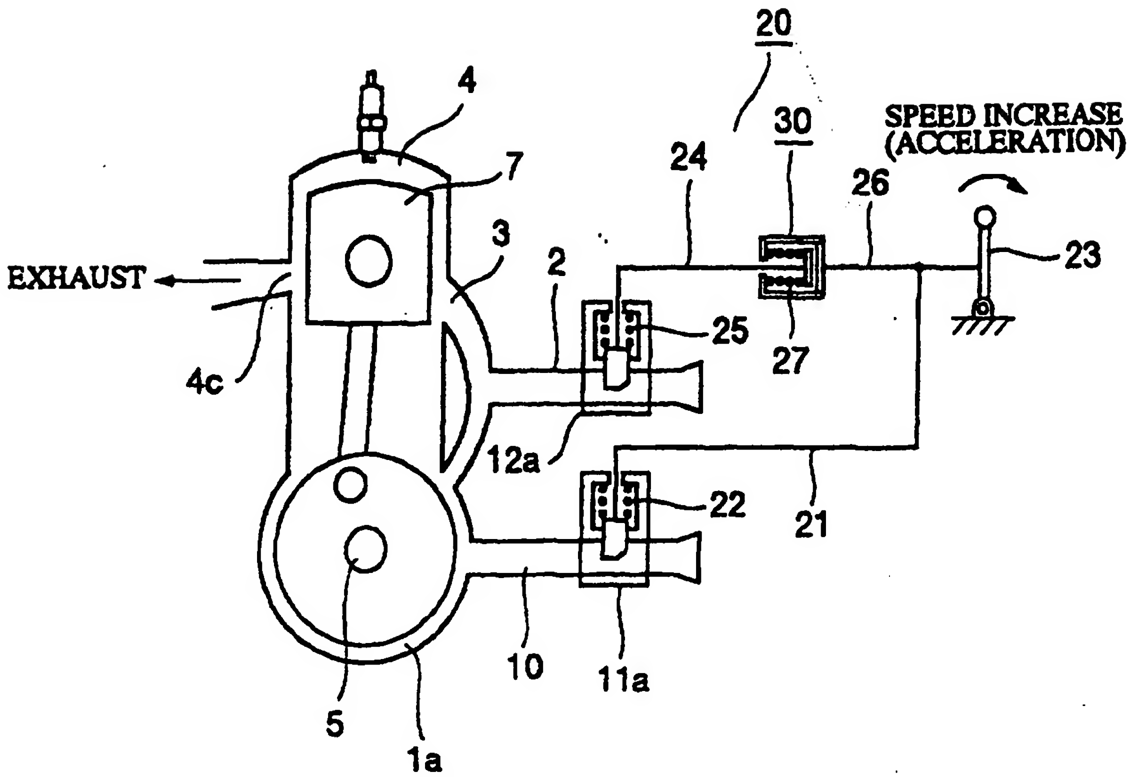
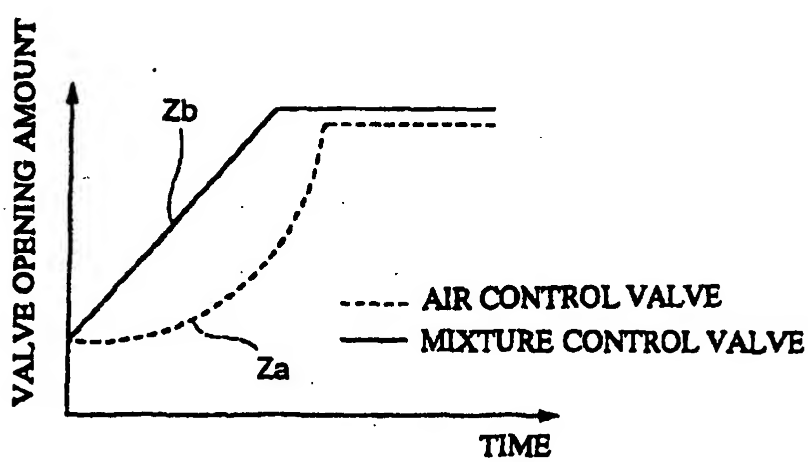

20
30
SPEED INCREASE
(ACCELERATION)
4
7
24
26
3
2
EXHAUST
23
25
27
4c
12a
22
21
10
11a
5
1a

FIG.4


VALVE OPENING AMOUNT
Zb
AIR CONTROL VALVE
MIXTURE CONTROL VALVE
Za
TIME

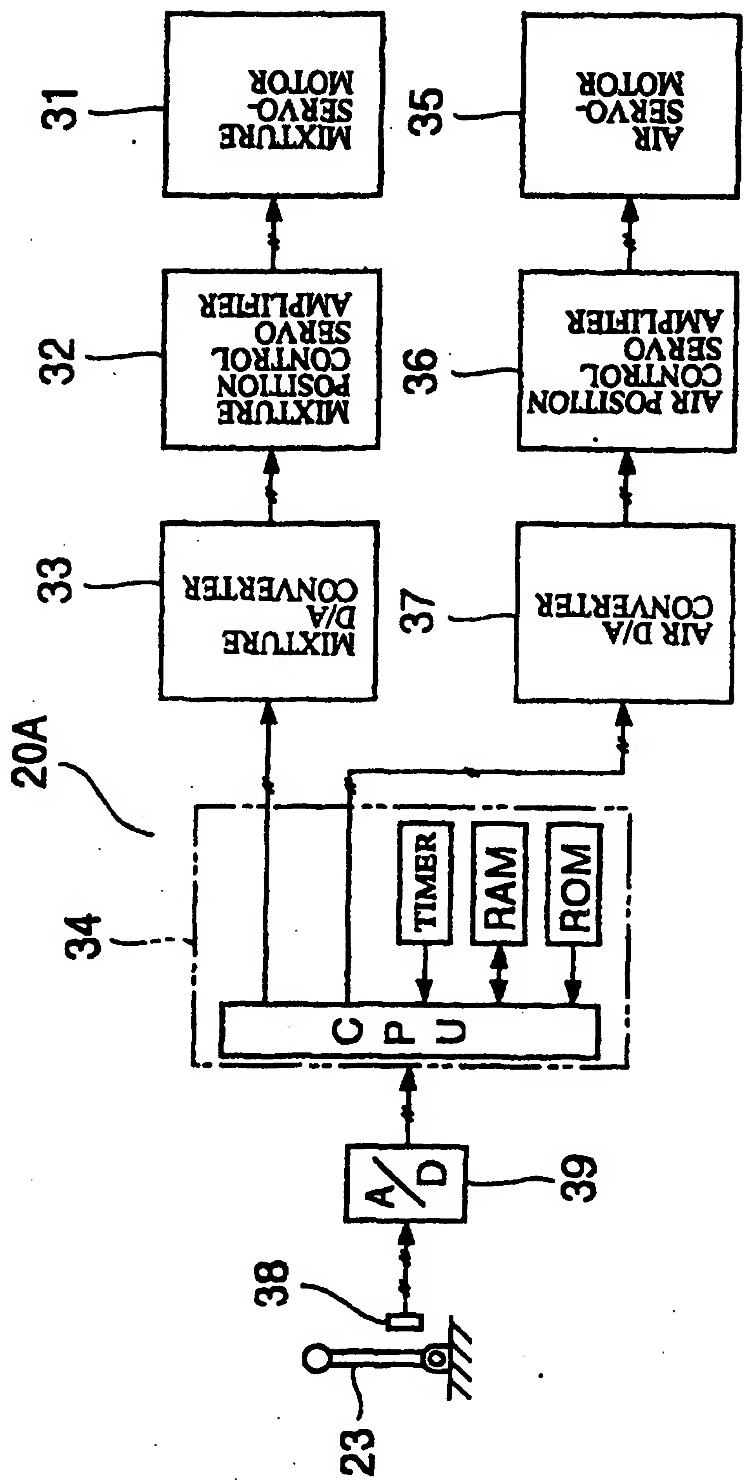

31
MIXTURE SERVO-MOTOR
32
MIXTURE POSITION CONTROL SERVO AMPLIFIER
33
MIXTURE D/A CONVERTER
35
AIR SERVO-MOTOR
36
AIR POSITION CONTROL SERVO AMPLIFIER
37
AIR D/A CONVERTER
20A
34
TIMER
RAM
ROM
CPU
A/D
39
38
23

FIG.5

FIG.6

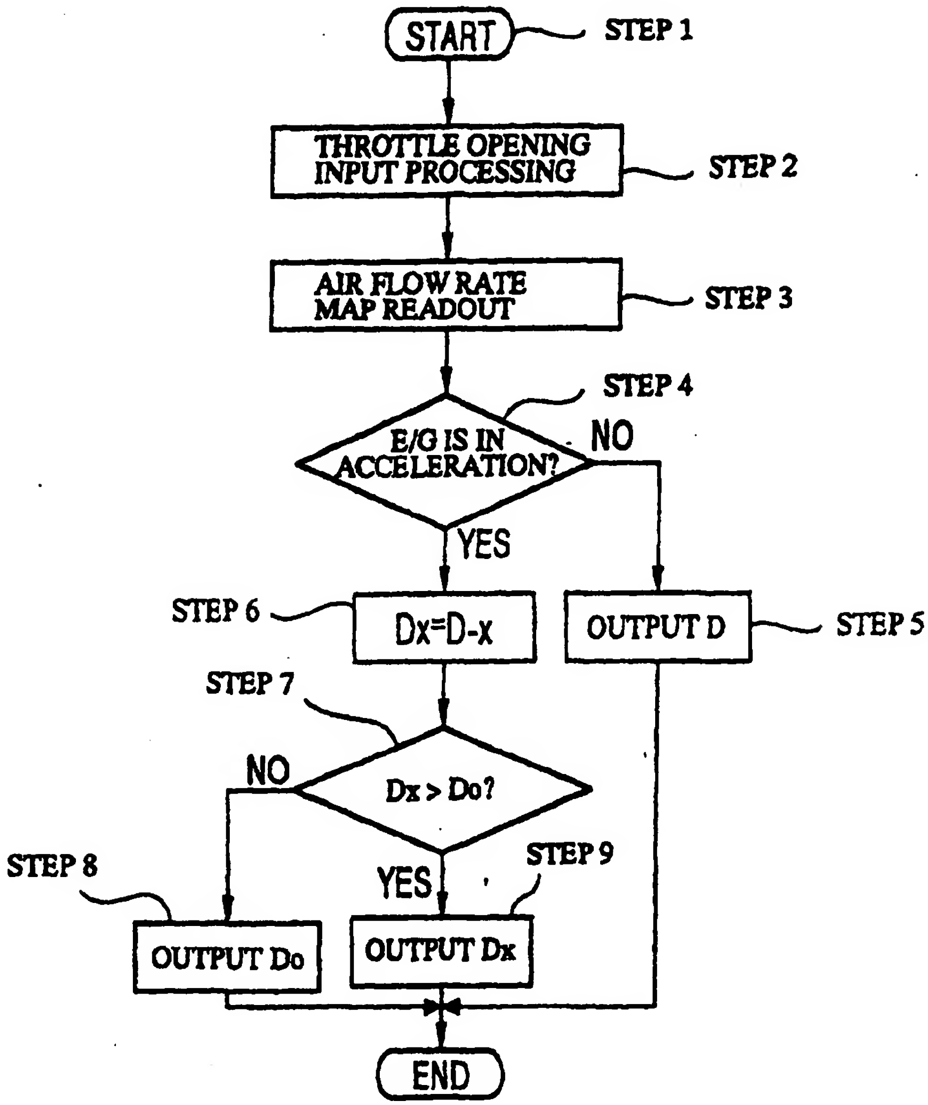

START
STEP 1
THROTTLE OPENING INPUT PROCESSING
STEP 2
AIR FLOW RATE MAP READOUT
STEP 3
STEP 4
E/G IS IN ACCELERATION?
NO
YES
STEP 6
Dx=D-x
OUTPUT D
STEP 5
STEP 7
NO
Dx > Do?
STEP 8
YES
STEP 9
OUTPUT Do
OUTPUT Dx
END

FIG.7

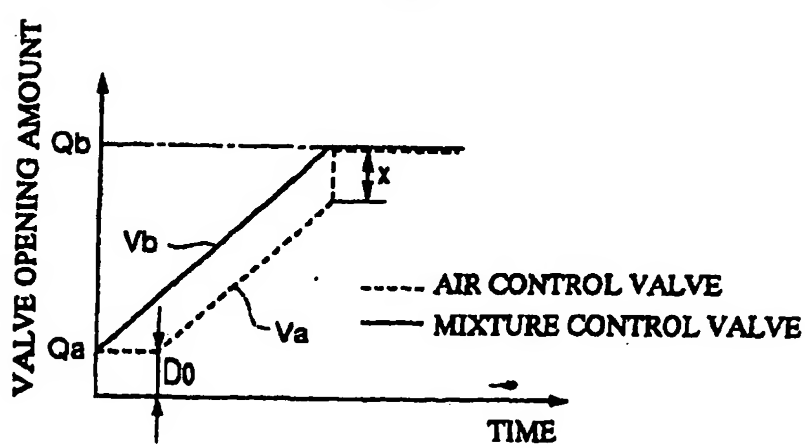

VALVE OPENING AMOUNT
Qb
x
Vb
Qa
Va
Do
AIR CONTROL VALVE
MIXTURE CONTROL VALVE
TIME

FIG.8

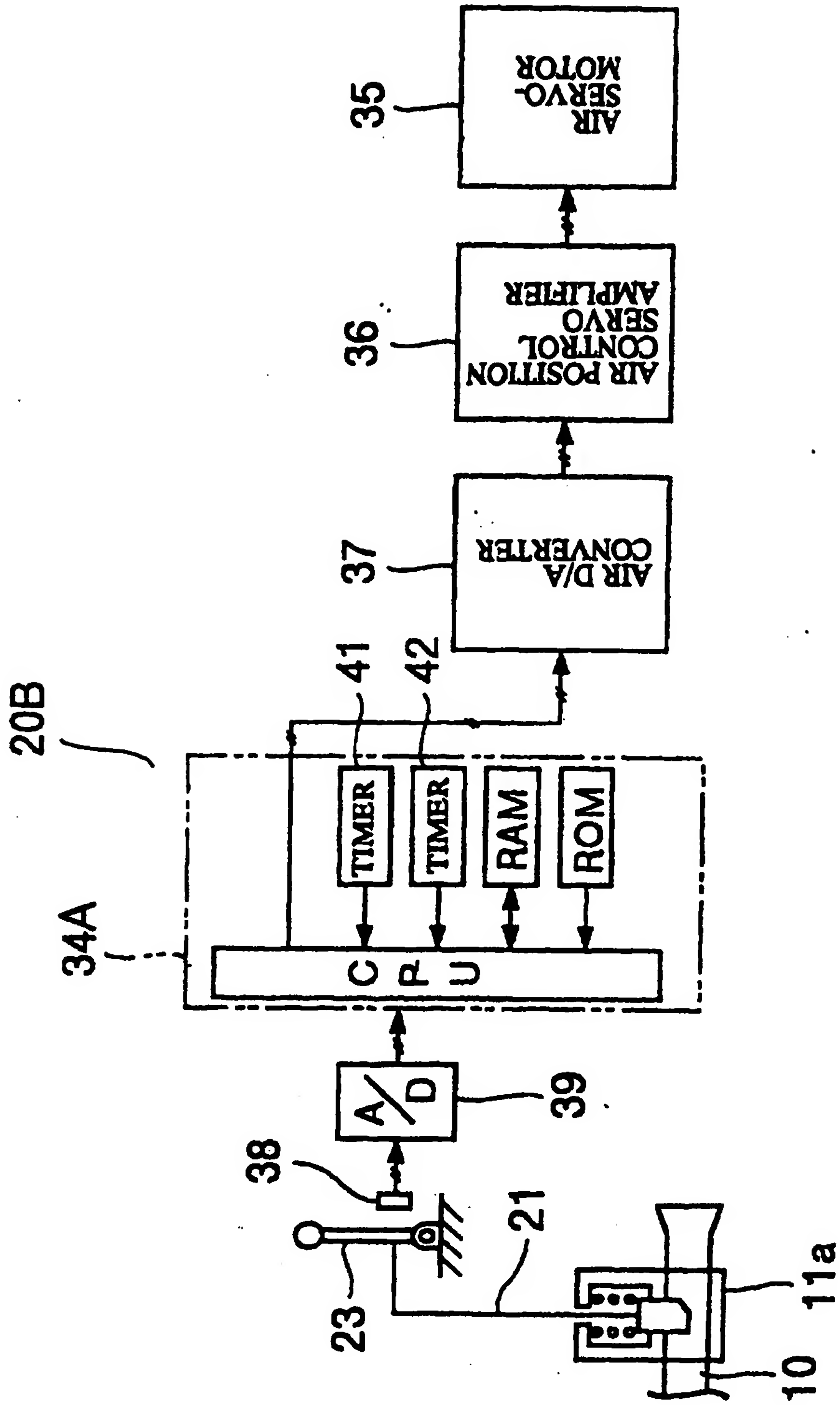

35
AIR SERVO-MOTOR
36
AIR POSITION CONTROL SERVO AMPLIFIER
37
AIR D/A CONVERTER
41
42
20B
TIMER
TIMER
RAM
ROM
34A
CPU
A/D
39
38
21
23
11a
10

FIG.9

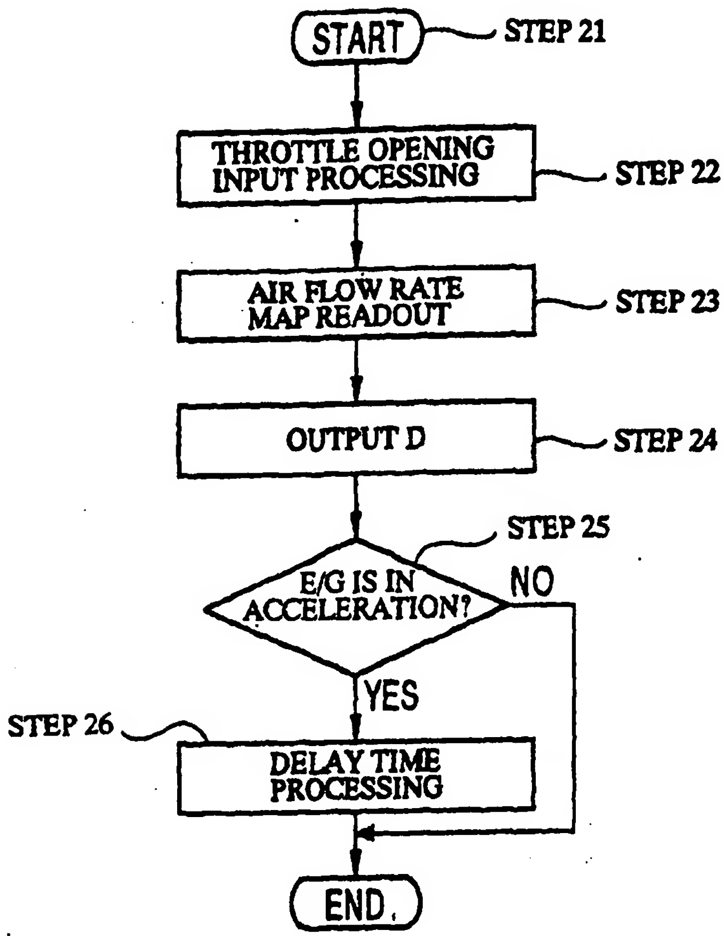
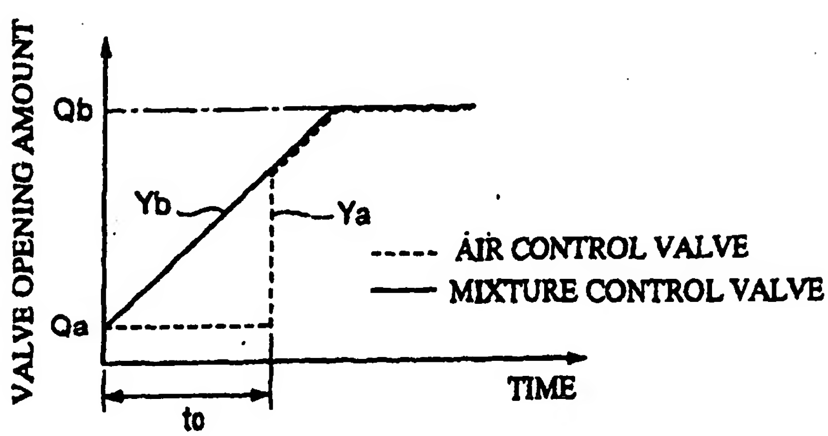

START
STEP 21
THROTTLE OPENING INPUT PROCESSING
STEP 22
AIR FLOW RATE MAP READOUT
STEP 23
OUTPUT D
STEP 24
STEP 25
E/G IS IN ACCELERATION?
NO
YES
STEP 26
DELAY TIME PROCESSING
END

FIG.10


VALVE OPENING AMOUNT
Qb
Qa
Yb
Ya
AIR CONTROL VALVE
MIXTURE CONTROL VALVE
TIME
to